

# **INFORMATION HANDOUT**

**For Contract No. 04-1SS464  
On Route 680  
At Monument Boulevard  
In Pleasant Hill in Contra Costa County**

**Identified by  
Project ID 0412000605**

## **MATERIALS INFORMATION**

1. Foundation Recommendation for Roadway Settlement
2. Mainline Pavement Repair Recommendations for PS&E

## Memorandum

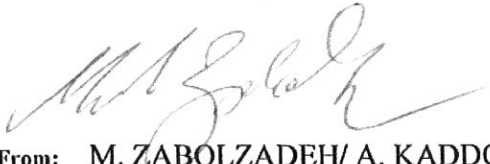
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To: MR. RON TSUNG  
District Office Chief  
Design – Contra Costa

Date: January 29, 2013

Attention: K. Kitamura  
Q. Fu

File: 04-CC-680 PM 17.9  
04-1SS460  
Efis: 0412000605-0  
PCC Slab Roadway Settlement

  
From: M. ZABOLZADEH/ A. KADDOURA  
Associate Materials & Research Engineers  
Office of Geotechnical Design – West  
Geotechnical Services  
Division of Engineering Services

  
HOOSHMAND NIKOUI  
Chief, Branch A  
Office of Geotechnical Design – West  
Geotechnical Services  
Division of Engineering Services

Subject : Foundation Recommendation for Roadway Settlement –Geotechnical Design Report

This is in response to your memorandum dated October 18, 2012 requesting our foundation recommendation for northbound Route 680 roadway settlement. The settlement is located on northbound Route 680, approximately 500 ft north of Monument Boulevard Undercrossing in the City of Pleasant Hill in Contra Costa County. See attached Exhibit A for all the details.

### Field Observation

- The settlement area is about 106 ft (between stations 205+70± and 206+76±) long and about 48 ft wide.
- The localized PCC pavement settlement area covers Lanes #2, #3, and #4. Most of the cracks within the settled area are located between Lanes # 2 and #3.
- The settlement area and its associated cracks appear to becoming worse since we visited the site on October 2012 and causing a big depression in the roadway.

### Background - As-Built Plans/Information on File

Based on the as built plans and as provided by Hydraulics Branch:

- There is an existing 18 inches RCP culvert at the depth of about 27 ft below roadway surface that crosses the freeway at the location of the settlement area. This culvert is part of the Drainage System 28 that was installed in the early 1960's under Contract 04-110304. At this location, the OG ground profile was raised about 12 feet to accommodate construction of the Monument Blvd UC structure. At that time, the

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resultant height of the inlets constructed in the 1960's was about 15 feet. In the late 1990's, early 2000's, the Monument Blvd interchange was reconstructed and the freeway widened under contract 04-377214. At the location of the existing Drainage System 28, the freeway profile was raised about 12 feet. According to the As-Built drainage plans (Contract 04-377214), this drainage system (#28) was to be abandoned. However, it is not clear whether this has been done properly (filled with slurry, or sands), or has been done at all. The existence of the 18 inches RCP culvert was confirmed when we drilled boring A-12-001 (December 12, 2012) and encountered some hard (concrete or metal) object and had to abandon the hole at the depth of about 27 ft below roadway level.

### **SCOPE OF WORK**

The following tasks were performed for the preparation of this Geotechnical Design Report (GDR):

- Field mapping.
- Field geotechnical exploration, including drilling two power borings.
- Review of the previously prepared memorandums by this office.
- Laboratory testing on selected samples.

### **SUBSURFACE SOIL CONDITIONS**

Two Power boring (A-12-001 and A-12-002) were drilled utilizing 4 inches hollow stem auger drilling method with Standard Penetration Test (SPT) sampling in December 2012 on the northbound lane within the settled area to the depths of 25.5 and 41.5 feet, respectively. The borings describe the foundation soils as approximately 23 feet of stiff to very stiff sandy lean clay (alluvium fill). The remainder of the borings describes the foundation soils as medium dense clayey sand/sand. The unconfined compressive strength of the clayey soil (using a pocket penetrometer) was estimated to range between 1.0 and 3.5 tsf. The SPT blow counts range from 5 to 32 blows per foot.

Groundwater was not encountered in any of the borings at the time during drilling (December 2012). Refer to the attached Log of Test Boring Sheets (LOTB) for details. The LOTB sheets should be included with the contract plans.

### **GEOTECHNICAL TESTING**

#### **Laboratory Testing**

Laboratory testing was performed on selected samples of the subsurface materials obtained during our subsurface investigation for moisture content. In-Situ tests include performing SPT and pocket penetrometer testing on clay soil samples.

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### **CONCLUSIONS**

Based on the above and our subsurface investigation and field observation, it appears that the following factors may have contributed to the settlement at this location:

- The existing drainage system (System 28) most probably is the main cause of the settlement. The roadway settlement area is directly above this system and the embankment material is soft with high moisture content to the depth of about 25 below roadway surface (location of the culvert). As mentioned above, the culvert may have not been abandoned properly, so loss of embankment fines through the culvert joints is highly possible. Due to the weight of additional fill over the existing culvert, the culvert may have collapsed.
- Poor compaction could be another reason for the settlement. In this scenario, lack of compaction has led in cracking the pavement PCC slabs allowing significant amount of surface runoffs to penetrate into the ground softening the embankment materials. This is evident from the relatively high moisture content of the soil samples retrieved from the borings.

### **FOUNDATION RECOMMENDATIONS**

#### **CEMENT COMPACTION GROUTING**

Regardless of the cause of the PCC settlements mentioned above, in order to mitigate settlement at this location, we recommend cement compaction grouting beneath Lanes #2, #3, and #4 (Station 205+70± to 206+76±) to the depth of maximum 25 ft below roadway surface. Refer to the attached Exhibit A for details.

In the strict sense, compaction grouting refers to the soil improvement technique of injecting under pressure grout of low slump/high internal friction to densify and compact the surrounding soil or fill and lift structure. The grout is most accurately classified as a Low Mobility (LMG) since the concept is that, upon injection, it retains a spherical, coherent grout mass, which, as it expands radially, causes densification.

The estimated quantity of cement grout required is about 4800 ft<sup>3</sup> (total of 176 grout holes).

It should be noted that the location of the grout injection holes are subject to change during construction and may vary according to field conditions and the required lifting.

Injecting grout will create an uneven pavement surfacing. After completion of the grouting, we recommend replacing the PCC slabs at the location of the settled and cracked areas.

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Refer to the attached non standard special provisions (NSSP) for more details. We will provide approval to use this NSSP.

\* \* \* \* \*

Any questions regarding the above recommendations should be directed to the attention of Mohammad Zabolzadeh/ Ali Kaddoura at 510-286-4831/4676 or Hooshmand Nikoui at 510-286-4811, at the Office of Geotechnical Design-West, Branch A.

Attachments:

cc: TPokrywka, HNikoui, MZabolzadeh, AKaddoura - (GS west), CTomimatsu Hydraulics (District 4), YHFathollahi (PM), KKitamura (Senior Engineer), QFu (PE)

Zabolzadeh-Kaddoura/mm/CC 680 PM 17.9-1SS460 GDR





**EXHIBIT A**

**04-CC-680-PM 17.9**

**04-ISS460, Ejis 0412000605**

**EXHIBIT A**

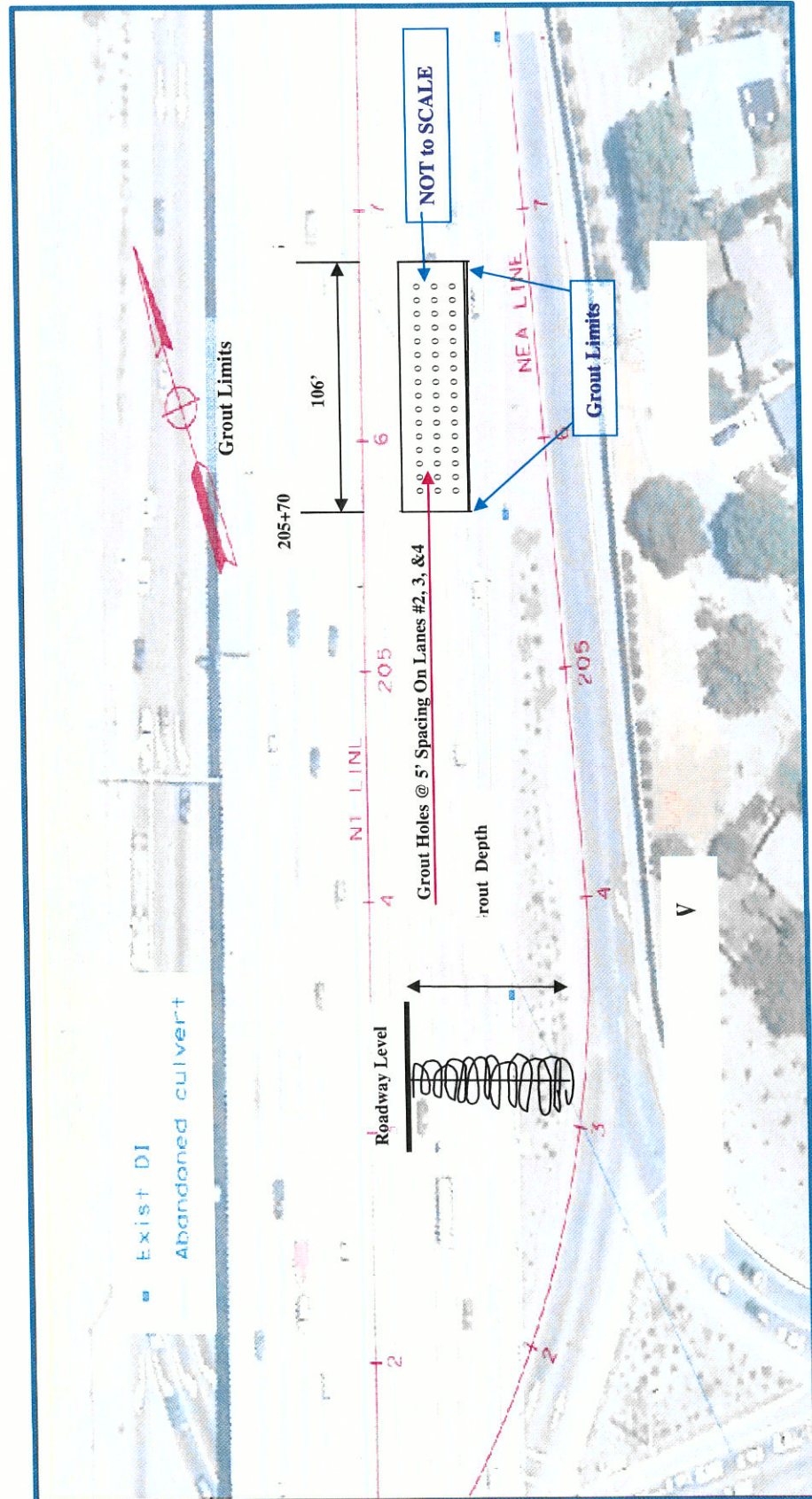
**04-CC-680-PM 17.9**

**04-ISS460, Ejis 0412000605**

**EXHIBIT A**

**04-CC-680-PM 17.9**

**04-ISS460, Ejis 0412000605**



## Memorandum

*Flex your power!  
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To: KENDALL KITAMURA  
Branch Chief  
Design Contra Costa

Date: October 17, 2013

Attn: Qi Fu

File: 04-CC-680-PM R17.9  
EA 04-1SS461  
Proj. ID 0412000605  
NB I-680 (Monument  
Blvd)

From:   
LUIS P. TACURI, P.E.  
D4 Materials Design Engineer  
Engineering Services I - Materials "A"

Subject: MAINLINE PAVEMENT REPAIR RECOMMENDATIONS FOR PS&E

### 1. INTRODUCTION

These pavement recommendations are needed to prepare a PS&E for a pavement repair project -- to mitigate an existing roadway settlement-- along northbound Interstate 680 north of Monument Boulevard Undercrossing (PM R17.9) in the city of Pleasant Hill in Contra Costa County.

Based on a "Foundation Recommendation for Roadway Settlement - Geotechnical Design Report," prepared by the D4 Office of Geotechnical Design - West, dated January 29, 2013, the scope of this project includes:

- Cement compaction grouting
- Slab replacements within the limits of the cement compaction grouting.

Additionally, per your information, a tire track repair --south of the Monument Boulevard UC-- will also be part of this project.

### 2. AS-BUILT PAVEMENT STRUCTURE

Based on the preliminary project plans provided to us and our research of the As-built plans, the existing mainline rigid pavement structure was constructed in 1999 under contract 04-377214 and consists of:

0.75' PCC  
0.25' ATPB  
0.25' AC (A)  
0.50' AS (4)

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Attn: Qi Fu

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### **3. SLAB REPLACEMENT RECOMMENDATIONS**

It is District 4 standard practice to replace failed concrete slabs with similar concrete materials. However, considering limited/short construction windows (less than 8 hours), we recommend using **Precast Slabs (preferred option)** or **Rapid Strength Concrete (RSC)** within the limits of the roadway settlement. Per Qi Fu's, the PE, information, within the limits of the tire track location, first, there are already concrete slabs that have cracked, and second, the cost of his initially repair strategy --polyester concrete overlay-- is about the same of slab replacements. Therefore, slab replacements can also be carried out to get rid of the existing tire track.

#### **3.1. Option 1 (preferred) - Precast Slabs**

Replace the failed concrete slabs with **precast slabs** matching the existing thickness (requires HQ approval to reduce the standard thickness of 0.90' to match the existing thickness of 0.75') and the existing ATPB layer with Cement Treated Permeable Base Rapid Setting (CTPBRS) also matching the existing thickness. The CTPBRS is required to extend the existing permeable layer in the adjacent pavement.

#### **3.2. Option 2 - Rapid Strength Concrete (RSC)**

Replace the failed concrete slabs with RSC and their underlying ATPB layer also with CTPBRS -- required to extend the existing permeable layer in the adjacent pavement. The RSC slab and the CTPBRS base will be replaced to the **same existing thicknesses** but separated by a "**bond breaker**" that is placed after the base has hardened sufficiently (e.g. hard enough to walk on). The purpose of the bond breaker is to allow for independent movement and thereby minimizing the potential for cracking.

**Regardless of the length of the required slab replacement, per recommendation from Tinu Mishra, the District Materials Engineer, the applicable 2010 Standard Plan is RSP 3A, dated July 19, 2013; to that effect, include a note in the Typical Cross Sections sheet. Likewise, the applicable Standard Special Provision is SSP 40-5, "Jointed Plain Concrete Pavement with Rapid Strength Concrete."**

Should you have any questions, please call me at (510) 622-1755 or Tinu Mishra at (510) 286-4841.

c: QFu / TMishra / LTacuri / Daily File / Materials File



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Attn: Qi Fu

October 17, 2013

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**DISCLAIMER**

*Any variations from the recommendations provided could have a significant impact. Members of this office bear no responsibility for any alterations that are made, for whatever reason, to the preceding design without prior discussion with and approval from either the author or the branch chief. Such alteration could lead to inadequate performance and premature failure of the constructed pavement structural section. Also, while the members of this office make every effort both to precisely follow the available standard methods for testing and design and to exercise sound engineering judgment, improper construction practices can have a negative impact on pavement performance irrespective of the accuracy practiced to obtain the recommended rehabilitation strategy.*